

WHAT IS CLAIMED IS:

1                    1.        A magnetoresistive sensor comprising:  
2                    a stack of magnetoresistive layers including an anti-ferromagnetic layer, a pinned  
3 layer, a non-magnetic layer, and a free layer;  
4                    an underlayer of said stack of magnetoresistive layers;  
5                    a magnetic domain control film; and  
6                    a pair of electrode films for supplying current to said stack of magnetoresistive  
7 layers;

8                    wherein a center position of an upper surface and a lower surface of said magnetic  
9 domain control film is positioned within a range of an upper surface and a lower surface of said  
10 free layer; and

11                   further comprising:  
12                   an underlayer formed below said magnetic domain control film; and  
13                   an amorphous metal film layer formed below said underlayer for controlling  
14 crystallization of said underlayer.

1                    2.        A magnetoresistive sensor according to claim 1, wherein  
2                    said stack of magnetoresistive layers comprises said underlayer, said anti-  
3 ferromagnetic layer, said pinned layer, said non-magnetic layer, said free layer and a protection  
4 layer formed in this order from the lower layer to the upper layer.

1                    3.        A magnetoresistive sensor according to claim 1, wherein  
2                    said stack of magnetoresistive layers comprises said underlayer, said anti-  
3 ferromagnetic layer, said pinned layer, said non-magnetic layer, said free layer, said upper non-  
4 magnetic layer, said upper pinned layer, said upper anti-ferromagnetic layer and a protection  
5 layer formed in this order from the lower layer to the upper layer.

1                    4.        A magnetoresistive sensor according to claim 1, wherein  
2                    said stack of magnetoresistive layers comprises said underlayer, said free layer,  
3 said upper non-magnetic layer, said upper pinned layer, said upper anti-ferromagnetic layer and a  
4 protection layer formed in this order from the lower layer to the upper layer.

1                   5.     A magnetoresistive sensor according to claim 1, wherein  
2                   said amorphous metal film layer is formed on any one of surfaces within a range  
3     from a lower surface of said underlayer to an upper surface of said non-magnetic layer of said  
4     stack of magnetoresistive layers.

1                   6.     A magnetoresistive sensor according to claim 1, wherein  
2                   said magnetoresistive sensor has a structure in which a lower surface of said free  
3     layer is flush with a lower surface of said magnetic domain control film, and a bias magnetic  
4     field of said magnetic domain control film is mainly applied to said free layer.

1                   7.     A magnetoresistive sensor according to claim 6, wherein  
2                   said underlayer is formed of Cr or Cr alloy and comprise a body-centered cubic  
3     lattice (BCC) polycrystal thin film, and polycrystal orientation to formed plane is isometric  
4     random crystal orientation having no particular crystal orientation.

1                   8.     A magnetoresistive sensor according to claim 1, wherein  
2                   said magnetic domain control film is formed of a Co alloy film, said underlayer  
3     disposed below said magnetic control film controls a crystallization state of said magnetic  
4     domain control film, and said amorphous metal film layer controls a crystallization state of said  
5     underlayer.

1                   9.     A magnetoresistive sensor according to claim 1, wherein  
2                   said magnetic domain control film is formed of a Co alloy film, said underlayer is  
3     formed of a Cr or Cr alloy film, and said amorphous metal film layer is formed of an Ni series  
4     alloy or Co series alloy film.

1                   10.    A magnetoresistive head constituted by using a magnetoresistive sensor  
2     according to claim 1.

1                   11.    A magnetoresistive sensor comprising:  
2                   a stack of magnetoresistive layers including an anti-ferromagnetic layer, a pinned  
3     layer, a non-magnetic layer, and a free layer;  
4                   an underlayer of said stack of magnetoresistive layers;

5 a magnetic domain control film; and  
6 a pair of electrode films for supplying current to said stack of magnetoresistive  
7 layers;  
8 wherein a center position of an upper surface and a lower surface of said free  
9 layer is positioned within range of an upper surface and a lower surface at a position near an end  
10 of said magnetic domain control film; and  
11 further comprising:  
12 an underlayer formed below said magnetic domain control film and  
13 an amorphous metal film layer formed below said underlayer for controlling  
14 crystallization state of said underlayer.

1 12. A magnetoresistive sensor according to claim 11, wherein  
2 said stack of magnetoresistive layers comprises said underlayer, said anti-  
3 ferromagnetic layer, said pinned layer, said non-magnetic layer, said free layer and a protection  
4 layer formed in this order from the lower layer to the upper layer.

1 13. A magnetoresistive sensor according to claim 11, wherein  
2 said stack of magnetoresistive layers comprises said underlayer, said anti-  
3 ferromagnetic layer, said pinned layer, said non-magnetic layer, said free layer, said upper non-  
4 magnetic layer, said upper pinned layer, said upper anti-ferromagnetic layer and a protection  
5 layer formed in this order from the lower layer to the upper layer.

1 14. A magnetoresistive sensor according to claim 11, wherein  
2 said stack of magnetoresistive layers comprises said underlayer, said free layer,  
3 said upper non-magnetic layer, said upper pinned layer, said upper anti-ferromagnetic layer and a  
4 protection layer formed in this order from the lower layer to the upper layer.

1 15. A magnetoresistive sensor according to claim 11, wherein  
2 said amorphous metal film layer is formed on any one of surfaces within a range  
3 from a lower surface of said underlayer to an upper surface of said non-magnetic layer of said  
4 stack of magnetoresistive layers.

1                   16.    A magnetoresistive sensor according to claim 11, wherein  
2                   said magnetoresistive sensor has a structure in which a lower surface of said free  
3 layer is flush with a lower surface of said magnetic domain control film, and a bias magnetic  
4 field of said magnetic domain control film is mainly applied to said free layer.

1                   17.    A magnetoresistive sensor according to claim 16, wherein  
2                   said underlayer is formed of Cr or Cr alloy and comprise a body-centered cubic  
3 lattice (BCC) polycrystal thin film, and polycrystal orientation to formed plane is isometric  
4 random crystal orientation having no particular crystal orientation.

1                   18.    A magnetoresistive sensor according to claim 11, wherein  
2                   said magnetic domain control film is formed of a Co alloy film, said underlayer  
3 disposed below said magnetic control film controls a crystallization state of said magnetic  
4 domain control film, and said amorphous metal film layer controls a crystallization state of said  
5 underlayer.

1                   19.    A magnetoresistive sensor according to claim 11, wherein  
2                   said magnetic domain control film is formed of a Co alloy film, said underlayer is  
3 formed of a Cr or Cr alloy film, and said amorphous metal film layer is formed of an Ni series  
4 alloy or Co series alloy film.

1                   20.    A magnetoresistive head constituted by using a magnetoresistive sensor  
2 according to claim 11.

1                   21.    A method of manufacturing a magnetoresistive sensor comprising:  
2                   (1) forming a multi-layered film containing an anti-ferromagnetic layer, a pinned  
3 layer, a non-magnetic layer and a free layer continuously and collectively in a vacuum on a  
4 substrate;  
5                   (2) applying a lift-off resist to form a track width on said continuous film;  
6                   (3) removing a region not applied with said lift-off resist to said non-magnetic  
7 layer, to said pinned layer, to said anti-ferromagnetic layer, or to an intermediate layer of said  
8 anti-ferromagnetic layer by utilizing ion beams or the like with a good reproducibility;

9 (4) forming an amorphous layer, an underlayer, a magnetic domain control layer  
10 and an electrode film layer at a region in which a portion of said multi-layered film is removed;  
11 and

12 (5) removing said resist for lift-off.

1 22. A method of manufacturing a magnetoresistive sensor according to claim  
2 21, wherein

3 forming said amorphous metal film layer, a surface oxidation layer of said  
4 amorphous metal film layer, said underlayer, said magnetic domain control film and said  
5 electrode film are conducted continuously in one identical vacuum vessel.